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Energy Management Subcommittee

SCTE STANDARD

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Standard Data Fields for Outside Plant Power

NOTICE

Document Types and Tags

Document Type: Specification

Document Tags:

☐ Test or Measurement	☐ Checklist	☐ Facility
☐ Architecture or Framework	☐ Metric	☒ Access Network
☒ Procedure, Process or Method	☐ Cloud	☐ Customer Premises

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1. Introduction

1.1. Executive Summary

One of the largest capital and operational expenditures a Multiple System Operator (MSO) faces is the outside plant power network. This standard will define the baseline information an operator should retain for access network powering.

1.2. Scope

This SCTE standard defines the attributes of hybrid fiber coax (HFC) outside plant power supply devices an operator should keep inventory of to accurately describe the power network. The data fields defined in this document are designed to capture all relevant unique characteristics of hybrid fiber coax powering devices. These attributes may be utilized to model utility power consumption, utility power versus inverter time, and over all power network performance in the outside plant. This document defines the outside plant from the outside wall of the hubsite (headend) to the distribution line end. This document will reference where, when, and how an operator should acquire the data and metadata.

1.3. Benefits

Once cable operators follow a consistent format for access network powering data, it will be easy to measure and compare data to expose areas of focus. After an operator begins to collect and monitor power supply data, comparison against utility billing information is possible. This may expose what has been considered duplicated or ghost accounts, see [SCTE 221] for reference of short and long-term benefits. When used in conjunction with [SCTE 212], [SCTE 211] allows operators to translate operational energy management successes into financial results. Furthermore, this standard defines the characteristics of access network planning which the industry can utilize to report power utilization and energy consumption.

1.4. Intended Audience

The intended audience for this standard are cable operators who manage access network powering, broadband network assurance, HFC planning design and deployment, network architects and analysts, field operations, energy management, and those responsible for measuring energy performance.

1.5. Areas for Further Investigation or to be Added in Future Versions

In future iterations of this document, a modernization of manual data collection methods could be considered. Improved methods through which an operator could receive power utility information such as billing rate and account numbers by having a direct connection or shared database, which removes a risk of data errors, could be considered. At the same time, an update to SCTE 205 preventive maintenance report will be considered.

Future generations of HFC access networks may require additional data fields and could be considered for inclusion in a later version of this standard. One possible example may be a fiber connection point for power supplies monitored optically through fiber to the premise (FTTP) architecture and future fuel source for standby for example hydrogen or solar.

2. Normative References

The following documents contain provisions which, through reference in this text, constitute provisions of this document. The editions indicated were valid at the time of subcommittee approval. All documents are subject to revision and, while parties to any agreement based on this document are encouraged to investigate the possibility of applying the most recent editions of the documents listed below, they are reminded that newer editions of those documents might not be compatible with the referenced version.

2.1. SCTE References

[SCTE 38-4] ANSI/SCTE 38-4 2017, Hybrid Fiber/Coax Outside Plant Status Monitoring SCTE-HMS-PS-MIB

[SCTE 205] SCTE 205 2014, Outside Plant Power Recommended Preventive Maintenance Procedure

[SCTE 212] ANSI/SCTE 212 2020 Cable Operator Energy Audit Framework and Establishment of Energy Baseline

[SCTE 221] SCTE 221 2020, Cable Operator Energy Audit Framework and Establishment of Energy Baseline

2.2. Standards from Other Organizations

No normative references are applicable

2.3. Other Published Materials

No normative references are applicable.

3. Informative References

The following documents might provide valuable information to the reader but are not required when complying with this document.

3.1. SCTE References

[SCTE 211] ANSI/SCTE 211 2020, Energy Metrics for Cable Operator Access Networks

[SCTE 238] ANSI/SCTE 238 2017, Operational Practice for Measuring and Baselining Power Consumption in Outside Plant Equipment and Power Supplies

3.2. Standards from Other Organizations

No informative references are applicable.

3.3. Other Published Materials

No informative references are applicable.

4. Compliance Notation

shall	This word or the adjective "***required***" means that the item is an absolute requirement of this document.
shall not	This phrase means that the item is an absolute prohibition of this document.
forbidden	This word means the value specified ***shall*** never be used.
should	This word or the adjective "*recommended*" means that there *may* exist valid reasons in particular circumstances to ignore this item, but the full implications *should* be understood, and the case carefully weighed before choosing a different course.
should not	This phrase means that there *may* exist valid reasons in particular circumstances when the listed behavior is acceptable or even useful, but the full implications *should* be understood, and the case carefully weighed before implementing any behavior described with this label.
may	This word or the adjective "*optional*" indicate a course of action permissible within the limits of the document.
deprecated	Use is permissible for legacy purposes only. Deprecated features *may* be removed from future versions of this document. Implementations *should* avoid use of deprecated features.

5. Abbreviations and Definitions

5.1. Abbreviations

CMTS	Cable Modem Termination System
DOCSIS®	Data Over Cable Service Interface Specifications
EMS	element management system
FTTP	fiber to the premise
GIS	geographic information system
GPS	Global Positioning System
HFC	hybrid fiber coax
kWh	kilowatt hours
MDU	multi dwelling unit
MIB	Management Information Base
MSO	Multiple System Operator
OSP	outside plant
PS	power supply
RF	radio frequency
S/N	serial number
SCTE	Society of Cable Telecommunications Engineers
SNMP	Simple Network Management Protocol

5.2. Definitions

Definitions of terms used in this document are provided in this section. Defined terms that have specific meanings are capitalized. When the capitalized term is used in this document, the term has the specific meaning as defined in this section.

access network	Utilized to transport information between a service provider and a plurality of users. Includes all active and passive equipment between the headend or hub and the demarcation point at the user premises
audit	A physical site visit to a power supply to confirm health, perform maintenance and or manually document device data / attributes
legacy	Equipment that cannot be monitored via DOCSIS® transponder and or cannot be maintained with current available materials
meter	Use of certified devices recognized by the power company for revenue billing purposes
monitoring	Use of non-certified measurements such as those available in OSP power supply add-on modules
operator	Person or organization accountable for Access Network performance
outside plant	Outside plant refers to all physical cabling and supporting passives (including cables, connectors, taps, cabinets, poles) and actives (including fiber nodes, remote PHY devices, remote MACPHY devices, amplifiers, line extenders, Wi-Fi, LTE) located between a headend or hub facility and a terminal demarcation point.
transponder	Interfaces with hybrid fiber coax (HFC) power supplies to provide communications to centralized element management systems (EMS)
terminal demarcation point	The point at which the outside plant ends and connects with the customer's on-premises wiring.

6. Background

Within any given operator’s footprint, the quantity of active devices is immense, requiring many distributed power supplies. It is very important to have a strategy and a methodology to collect power supply device performance data. Understanding and measuring power consumption, utilization and penetration is the only way an operator can produce and measure efficiencies.
Modeling is an important activity in planning next generation networks. Investing in future networks will require detailed measurement and control on the HFC power network.

6.1. Outside Plant Power Supplies

Outside plant (OSP) power supplies are comprised of two main functions, transformer, and transponder. Power supply transformers are used to step down utility power and provide appropriate voltage for active devices such as HFC amplifiers. These actives in turn propagate signals from the cable operator to the customer. Transponders may share telemetry with an element management system.

6.2. Telemetry

Most outside plant power supplies deployed within the last 15 years may be monitored through internal DOCSIS® transponders. Performance and fault data may be visualized and monitored through an element management system (EMS). The operator *should* monitor the performance and fault metrics according to SCTE-HMS-PS-MIB [SCTE 38-4]. If performance and fault metrics are monitored, they ***shall*** be according to SCTE-HMS-PS-MIB [SCTE 38-4].

Performance metrics *should* be polled approximately every 5 minutes whereas properties such as device make, or model *may* be decreased to 24 hours. You should reference SCTE 238 for baselining power consumption in the outside plant and power supplies.

Commonly deployed commercially manufactured power supply status monitoring equipment can be seen as examples of equipment generated data as outlined within this standard. [1] The reader is urged to contact manufacturers of power supplies that they use for additional information.

6.3. Collection and Cadence

Prior to or during power supply installation, information ***shall*** be physically or digitally documented and stored in an EMS or geographic information system (GIS). This data *should* incorporate all details that describe the device location, properties, performance metrics, standby power potential, utility account, and access network information.

It is best practice to confirm and or correct all data attributes during regular power supply maintenance as described in [SCTE 205] the outside plant preventive maintenance procedure. Where a power supply is not connected via Simple Network Management Protocol (SNMP) a manual collection of information is required. A user ***shall*** input text to a physical or virtual form and submit to a GIS / EMS. "It is necessary to complete a preventive maintenance certification report, either manually or electronically." [SCTE 205]

Power supply data *should* be merged with utility account information and compared in full as described in [SCTE 212]."Monthly data *should* be obtained from the utility provider or cable operator for at least one year retroactively to optimally allow outlining trends. The monthly tracking *should* be in synch with the MSO's monthly accounts payable process."

6.4. Manual Measurement Tools

A true root mean square (RMS) digital multimeter, battery conductance tester, and inferred thermometer are required to collect the necessary data.

7. Data Fields

7.1. Location

Operators *shall* document the location attributes in Table 1. To reduce manual data entry errors, operators *should* configure a physical or virtual form to only include relevant options to select based on Data Type. [See Figure 1]

Table 1 – Location Attributes

Data Field	Data Type	Description	Manual Collection
Province / State	Char (2)	where PS is located	selection input
County / City	Varchar (31)	where PS is located	selection input
Hubsite / Headend	Varchar	signal generation	selection input
Provisioned Node	Varchar	RF generation	selection input
Physical Address	Varchar	where PS is located	text input

[1] Remote monitoring and measuring equipment such as AlphaNet™ DSMDS3.0M, Continuity, Cheetah XD Element Management Systems, or the equivalent. This identification of products or services is not an endorsement of those products or services or their suppliers.

Data Field	Data Type	Description	Manual Collection
Latitude GPS	Decimal(10,8)	mercator projection	text input
Longitude GPS	Decimal(11,8)	mercator projection	text input

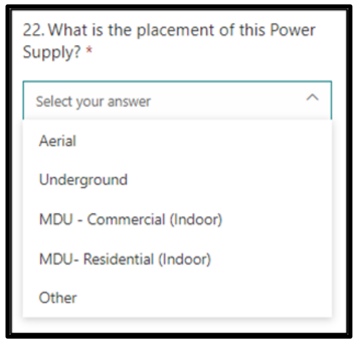

Figure 1 - Example preconfigured selection options

7.2. Device Properties

Operators ***shall*** document these properties found in Table 2. To reduce manual data entry errors, operators *should* configure a virtual form to only include calendar selection for Date Data Fields, see Figure 2

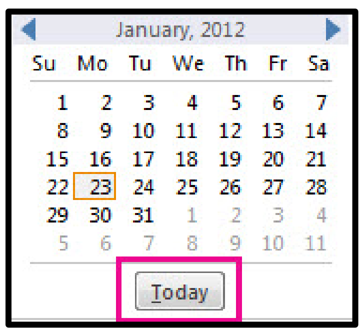

Figure 2 - Example calendar selection for Date fields

Where using manual forms operators ***shall*** use date format MM/DDYY.

Table 2 – Device Properties

Data Field	Data Type	Description	Manual Collection	SCTE MIB / OID*
Device ID	Integer	unique device Id	text input	
PS Make	Varchar	manufacturer	text input	commonVendor.0 .1.3.6.1.4.1.5591.1.3.1.2.0
PS Model	Varchar	model	text input	psDeviceID.1 .1.3.6.1.4.1.5591.1.4.2.1.4.1
PS Serial Number	Varchar	physical S/N	text input	
PS Manufacture Date	Date	date power supply was made	text input	
PS Modem Type	Varchar	type of transponder	text input	commonModelNumber.0 .1.3.6.1.4.1.5591.1.3.1.3.0

Data Field	Data Type	Description	Manual Collection	SCTE MIB / OID*
PS Modem Serial Number	Varchar	S/N of transponder	text input	commonSerialNumber.0 .1.3.6.1.4.1.5591.1.3.1.4.0
CM Mac Address	Char(12)	unique modem id	text input	
CPE Mac Address	Char(12)	unique modem id	text input	
Install Date	Date	active on network	calendar input	
Placement	Varchar	indoor, pole, ground	selection input	

*OID are referring to power supply device address 1 only.

7.3. Performance Data

Operators ***shall*** document the data fields in Table 3

Table 3 – Performance Data Fields to Document

Data Field	Data Type	Description	SCTE MIB / OID*
Input Voltage	smallint	Volts unit	psInputVoltage.1 .1.3.6.1.4.1.5591.1.4.2.1.23.1
Input Watts	smallint	Watts unit	psPowerIn.1 .1.3.6.1.4.1.5591.1.4.2.1.33.1
Output Voltage	smallint	Volts unit	psOutputVoltage.1 .1.3.6.1.3.6.1.4.1.5591.1.4.2.1.22.1
Output Current	smallint	Amps unit	psOutputCurrent.1.1 .1.3.6.1.4.1.5591.1.4.5.1.3.1.1
Output Watts	smallint	Watts unit	psPowerOut.1 .1.3.6.1.4.1.5591.1.4.2.1.30.1
PS Efficiency	smallint	calculated as percentage	N/A
Inverter Status	smallint	on or off	psInverterStatus.1 .1.3.6.1.4.1.5591.1.4.2.1.24.1
Temperature	smallint	Celsius or Fahrenheit	SCTE psTemperature.1.1 .1.3.6.1.4.1.5591.1.4.6.1.3.1.1
Battery Strings	tinyint	standby potential	psBatteryStrings.1 .1.3.6.1.4.1.5591.1.4.2.1.6.1
Battery Per String	tinyint	string potential	psBatteries.1 .1.3.6.1.4.1.5591.1.4.2.1.5.1
String Voltage	smallint	Volts unit	psTotalStringVoltage.1 .1.3.6.1.4.1.5591.1.4.2.1.28.1

*OID are referring to power supply set at address 1 only.

Manual data collection processes ***shall*** follow the methods in Table 4.

Table 4 – Performance Data Manual Collection Method

Data Field	Manual Collection
Input Voltage	Measurement Input Voltage ***shall*** be measured at the Utility connection, receptacle, prior to power supply
Input Watts	Input Watts (real power) ***shall*** be measured at the input to the ferro resonant transformer.
Output Voltage	Output Voltage ***shall*** be measured at the output of the ferro resonant transformer
Output Current	Output current ***shall*** be measured at the output of the ferro resonant transformer
Output Watts	Output watts (real power) ***shall*** be measured at the output of the ferro resonant transformer
PS Efficiency	Efficiency ***shall*** be calculated by dividing output watts by Input watts (WOUT ÷ WIN) 100 = %.
Inverter Status	Visually inspect the power supply inverter and document status, is it on or off.
Temperature	Temperature ***shall*** be read on most devices physical display panel, or by using non-contact infrared (IR) thermometer
Battery Strings	Operator ***shall*** visually inspect and record the amount of battery strings are connected
Battery Per String	Operator ***shall*** visually inspect and record how many batteries are connected per battery string.
String Voltage	String voltage ***shall*** be calculated by adding together the individual battery voltage of all batteries connected to the string

Line A ferroresonance power supply with battery backup *should* be deployed in a manner that loads them efficiently, ideally maintaining 84% or greater efficiency by placing an optimally sized line power supply for the AN load.

Power supplies should be sized according to volt-amperes, to best utilize the correctly sized ferro.

Output volt - amperes (apparent power) shall be calculated by multiplying output voltage by output amperes [EOUT * IOUT].

7.4. Standby Power

The operator ***shall*** document these data fields: the position of a battery and which string a battery is connected to. These can be derived through the SCTE MIB OIDs. For example, using the psBatteryVoltage.1.1.1 the numerical character describes the battery's location in this format (device 1. battery string 1. battery 1). Using this method an operator is able to configure an EMS to visualize battery position.

Standby Power table and Data Fields *should* be repeated for each unique battery in each string.
For example: Battery 1 String1, Battery 2 String1, Battery 3 String1.

Table 5 – Standby Power Data Fields

Data Field	Data Type	Description	SCTE MIB / OID*
Battery Position	Varchar	battery location	

Data Field	Data Type	Description	SCTE MIB / OID*
Battery Make	Varchar	Manufacture	
Battery Model	Varchar	model of battery	
Manufacture Date	Date	date made	
Install Date	Date	connected to PS	
Conductance	Integer	state of health	
Individual Battery Voltage	smallint	Volt unit	psBatteryVoltage.1.1.1 .1.3.6.1.4.1.5591.1.4.4.1.4.1.1.1

Note: *MIB / OID are referring to power supply device address 1 only.

Manual data collection processes ***shall*** follow the methods in Table 6.

Table 6 – Standby Power Manual Collection Process

Data Field	Manual Collection
Battery Position	selection input
Battery Make	selection input
Battery Model	selection input
Manufacture Date	calendar input
Install Date	calendar input
Conductance	A physical test ***shall*** be done with a conductance tester connected directly to the battery terminals.
Individual Battery Voltage	A physical test ***shall*** be done connected directly to the positive and negative terminals of a battery, as shown in Figure 3.

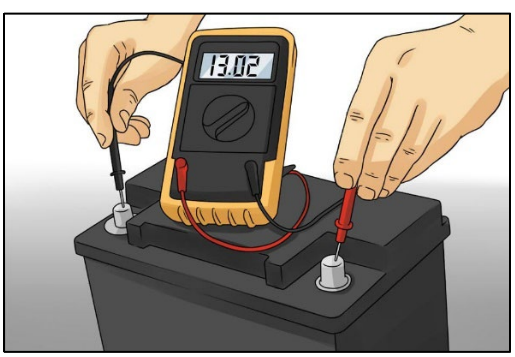

Figure 3 – Testing Battery Terminals for Voltage Using a Digital Multimeter

7.5. Power Provider

"Large utilities have the capability of billing electronically using electronic data interchange (EDI). In these cases, extraction is simple. Many of the smaller utilities offer web access to accounts and monthly data extraction can be automated." [SCTE 221]. The operator ***shall*** document these data fields in Table 7.

The operator *should* attempt to connect utility account and billing data source into the same GIS / EMS which contains the HFC powering data. This automation would allow near real time understanding of cost of ownership. It is important for an operator to have a single pane view of active operational power devices alongside active utility billing information. This allows for easy reconciliation with utilities on any account errors and supports budget forecasting and trending for cable operators.

Table 7 – Power Provider Data Fields

Data Field	Data Type	Description	Manual Collection
Power Utility Name	Varchar	company name	text input
Master Account Number	Varchar	accounting line	text input
Account Number:	Varchar	billing account	text input
Account Open Date	Date	billing start	text input
Account Closed Date	Date	billing stop	text input
Installation ID	Varchar	connection workorder	text input
Pole ID / Service Box ID	Varchar	connection ID	text input
Connection Latitude	Decimal(10,8)	mercator projection	text input
Connection Longitude	Decimal(10,8)	mercator projection	text input
Measurement Type	Varchar	meter / flat rate	text input
Meter Number	Varchar	utility meter number	text input
Rate	Decimal	billing rate in kw/h	text input
Co-Located	Varchar	more than one PS share one service connection	selection input
Co-Locate Device ID**	Integer	unique identifier of PS	text input

**If multiple PS share one utility service document multiple Device ID's.

7.6. Access Network

Operators *may* consider the attributes in Table 8 for modeling and planning of network expansions.

Table 8 – Network Expansion Attributes

Data Field	Data Type	Description	Manual Collection
Total Properties	Integer	potential customers	text input
Type of Properties	Integer	single, MDU, commercial	selection input
Total Subscribers	Integer	customers on billing	text input
Total Dependents	Integer	child devices	text input
Miles / KM of Network	Integer	linear coax length	text input
Coax Type	Varchar	coax technology	selection input
Coax Size	Varchar	coax diameter	selection input

